



New biomass-to-liquid process from wood chips to motor fuels

COMSYN project concept evaluation

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Knowledge for Tomorrow



Agenda

COMSYN – Project concept and objective

Techno economic evaluation at DLR

Results based on preliminary data

Summary & Outlook





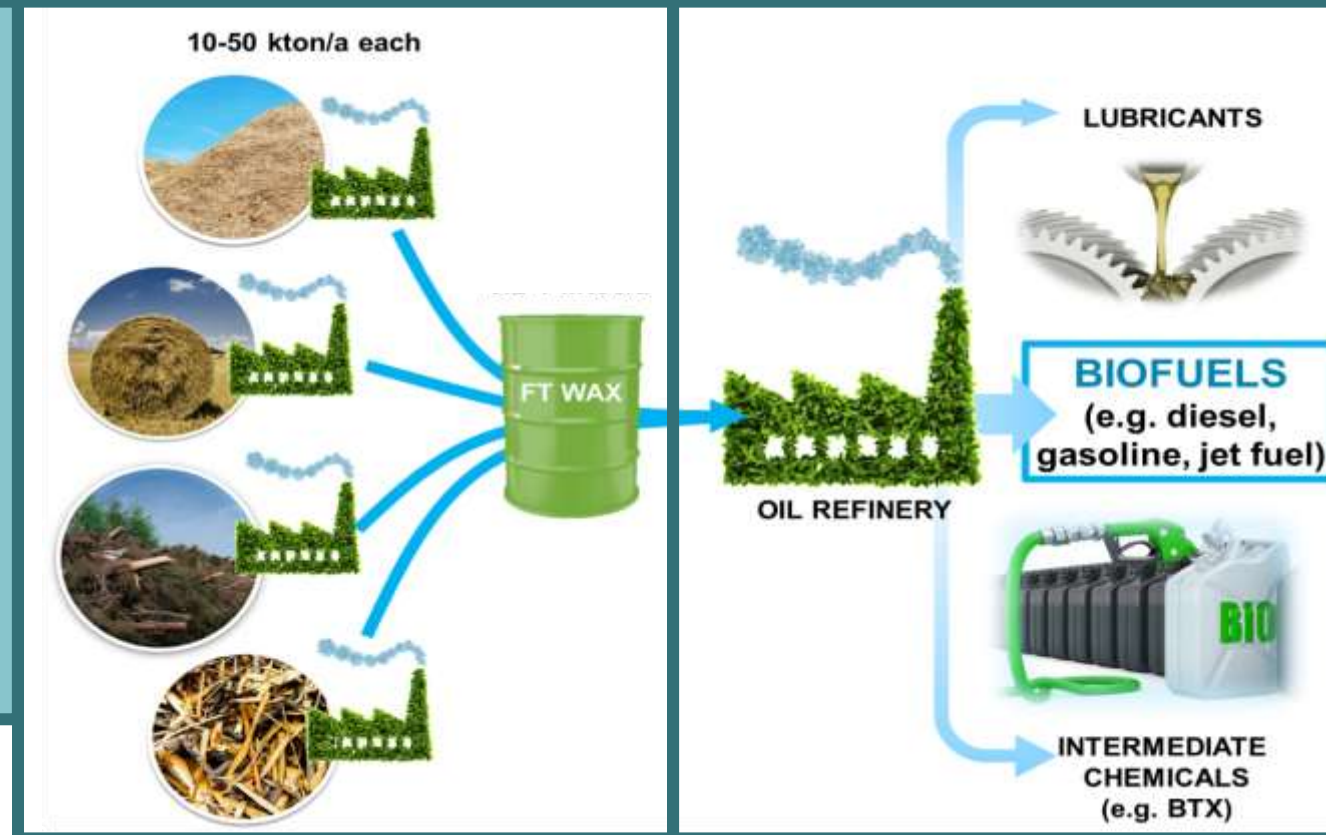
COMSYN – Compact Gasification and Synthesis process for Transport Fuels

www.comsynproject.eu – EU No. 727476

New BTL production concept with biofuel production **cost reduction** up to 35 % compared to alternative routes (< 0.80 €/l production cost for diesel)

PRIMARY CONVERSION

Decentralized FT wax production at **small-to-medium scale** units located close to biomass resources (50-150 MW_{th} input) + locally utilized excess heat for 80+ % overall efficiency



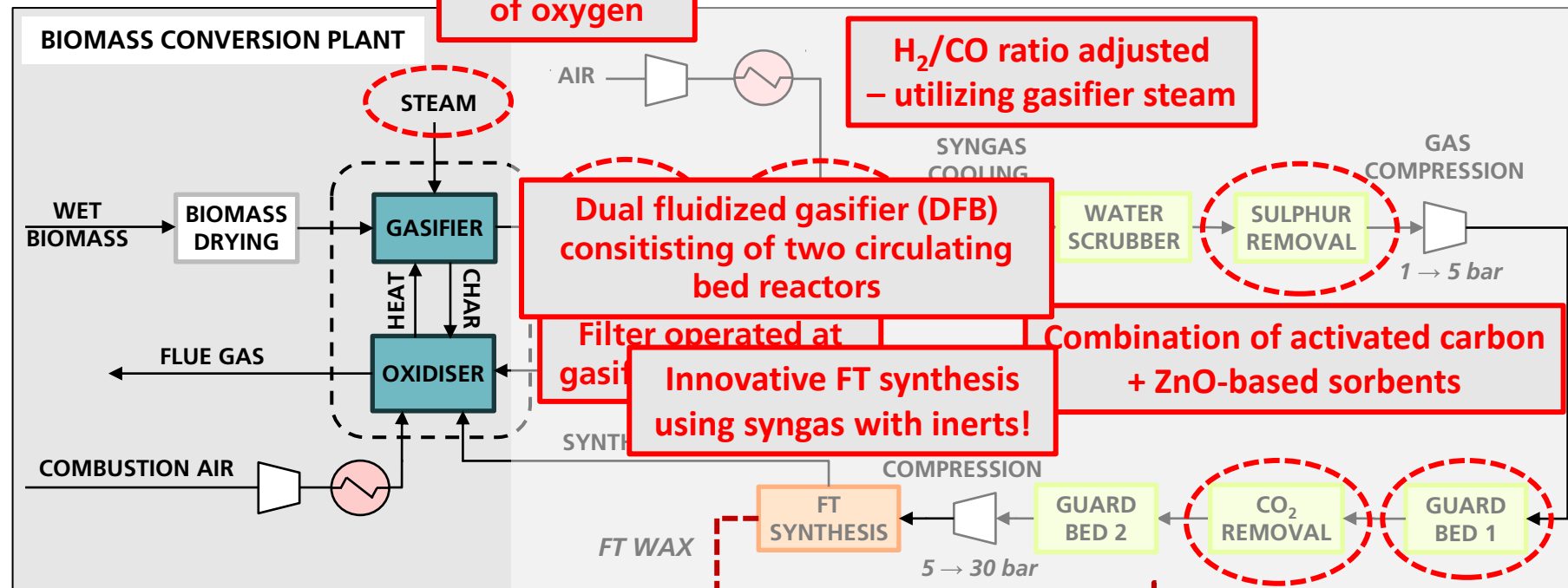
PRODUCT UPGRADING

Centralized FT product refining to high quality drop-in liquid fuels* at existing oil refineries



COMSYN – Compact Gasification and Synthesis process for Transport Fuels

Project concept



Highlights

- No need for an oxygen plant
- Intermediate cooling/reheating steps eliminated
- Separate WGS unit eliminated
- Simplified Sulphur removal
- No CO₂ removal or partial removal by pressure water scrubbing



TRANSPORTATION LIQUIDS



OIL REFINERY



INDUSTRY / DISTRICT HEATING



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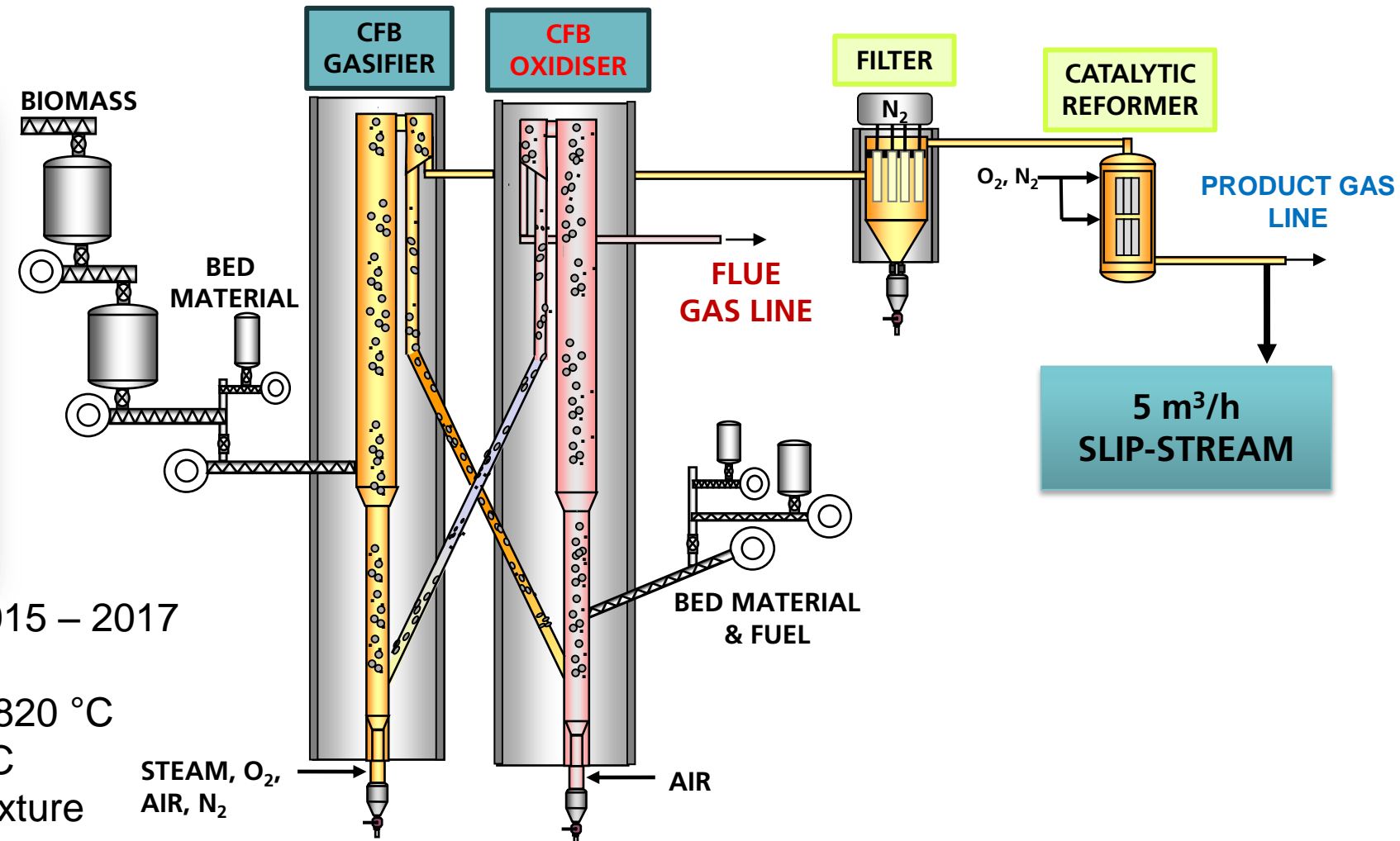
Dual Fluidized Bed Gasification with circulating bed material

DFB PILOT PLANT @ VTT



Gasifier Features:

- commissioned in 2015
- woody feedstocks operation 2015 – 2017
- fuel feed rate ca. 50 kg/h
- gasification temperature 750 - 820 °C
- oxidizer temperature ca. 900 °C
- bed material: dolomite/sand mixture

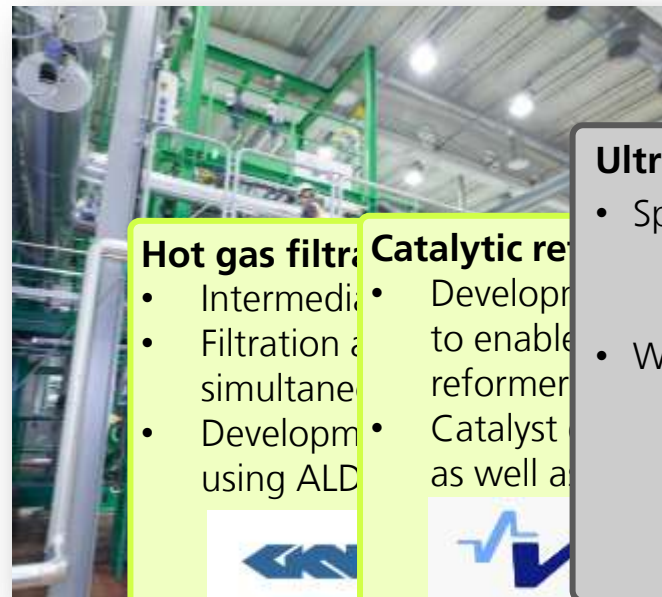




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Project concept – Gas cleaning & synthesis section

DFB PILOT @ VTT



Hot gas filter

- Intermediate
- Filtration and simultaneous
- Development using ALD

Catalytic reformer

- Development to enable reformer
- Catalyst as well as

Ultracleaning concept:

- Specifically for biomass-based gas
 - Low to medium sulphur content
 - Residual hydrocarbons (tar)
- Wet scrubbing acid gas process
 - Simpler dry bed desulphurization
 - No removal of CO₂ or partial oxidation
- Water scrubbing to 5 vol-%

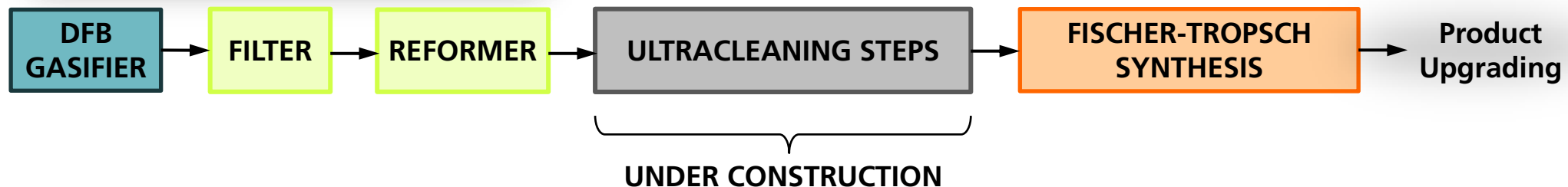
MOBILE SYNTHESIS UNIT



Fischer-Tropsch microreactor:

- Compact and modular design
- High efficiencies
- Load flexible

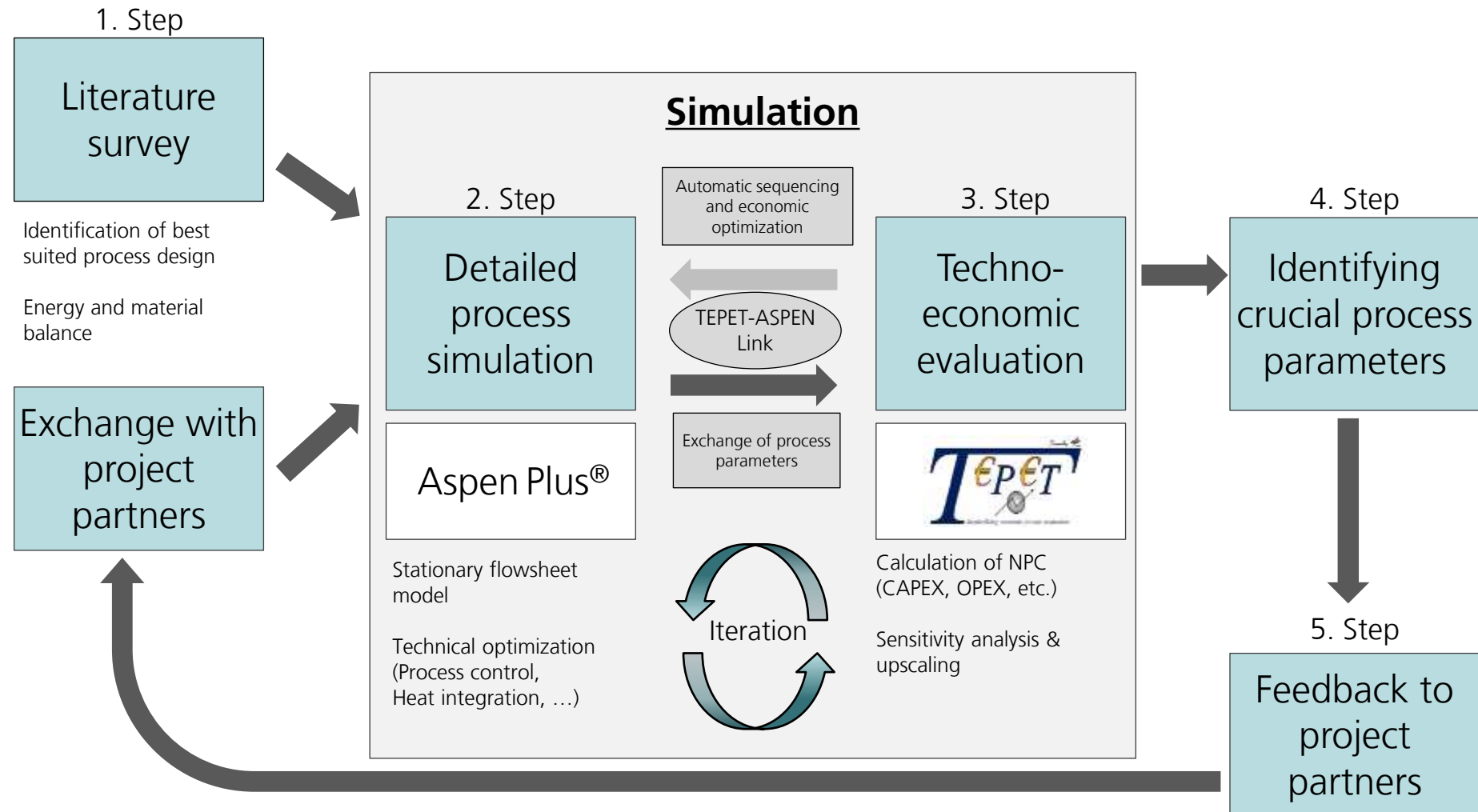
INERATEC





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Techno-economic assessment @ DLR

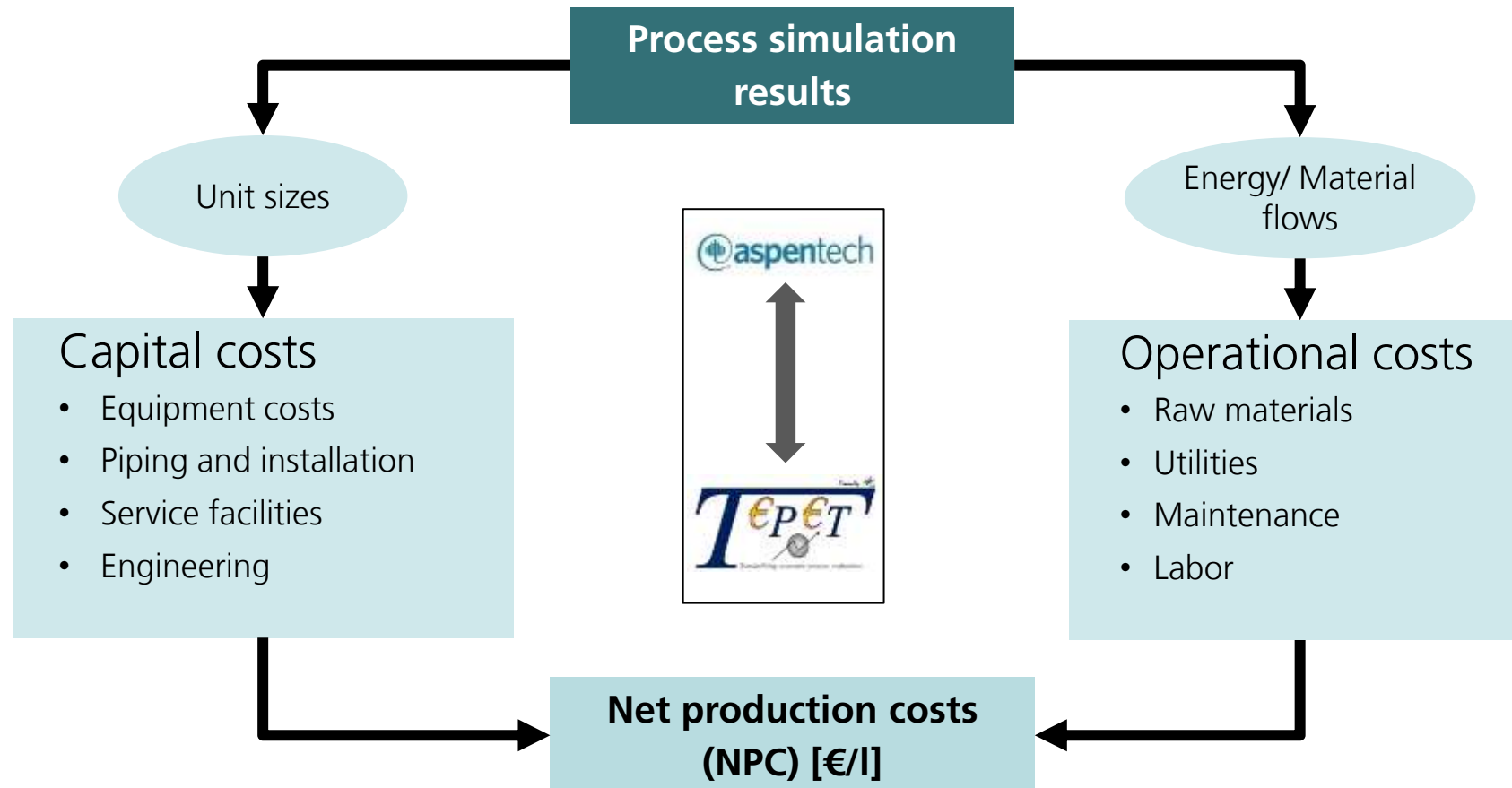




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Techno-economic assessment @ DLR

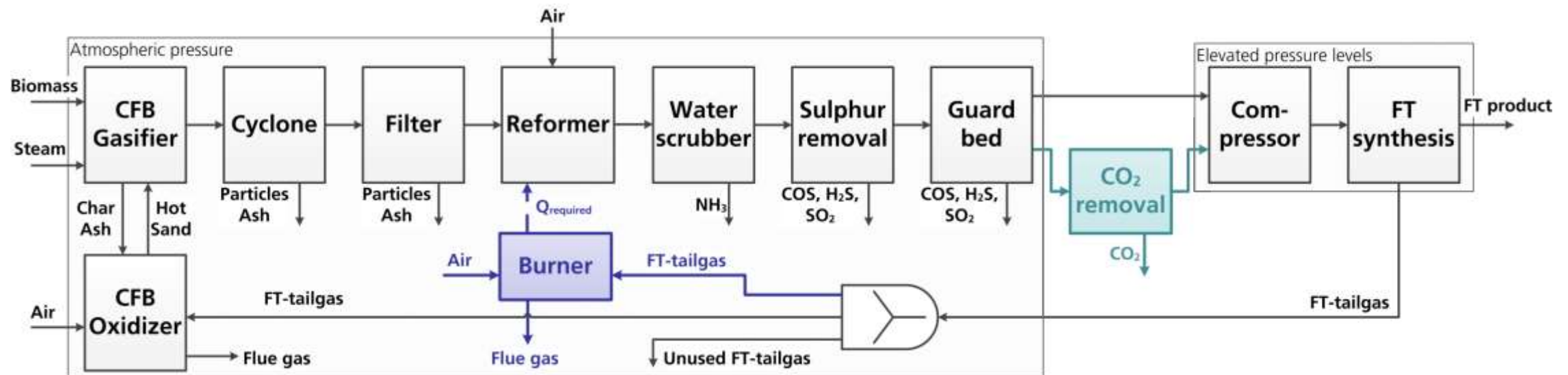
According to AACE Recommended Practice Class III + IV (Expected Accuracy: $\pm 30\%$)





COMSYN – Compact Gasification and Synthesis process for Transport Fuels

Evaluation of three process configurations



Case 1

- Initial project configuration (project proposal)
- Autothermal reforming with air

Case 2

- Autothermal reforming with air
- **CO₂ removal** after guard bed
 - Operating at 5 bar
 - 80 % CO₂ is absorbed

Case 3

- **Allothermal** reforming
 - Required heat is provided by an additional burner
 - No air is led into the reformer



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TEA – Preliminary results (100 MW_{th} input) before FT performance optimization

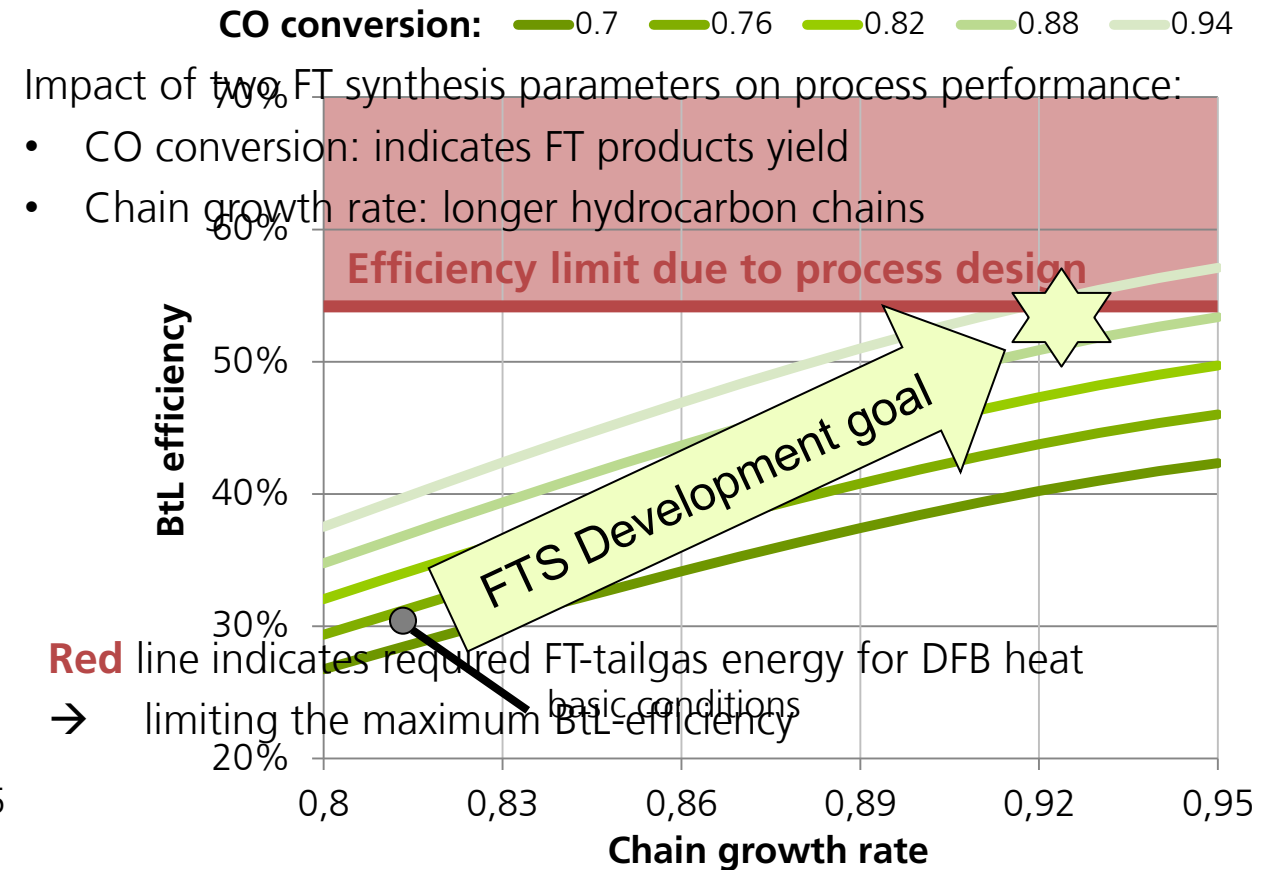
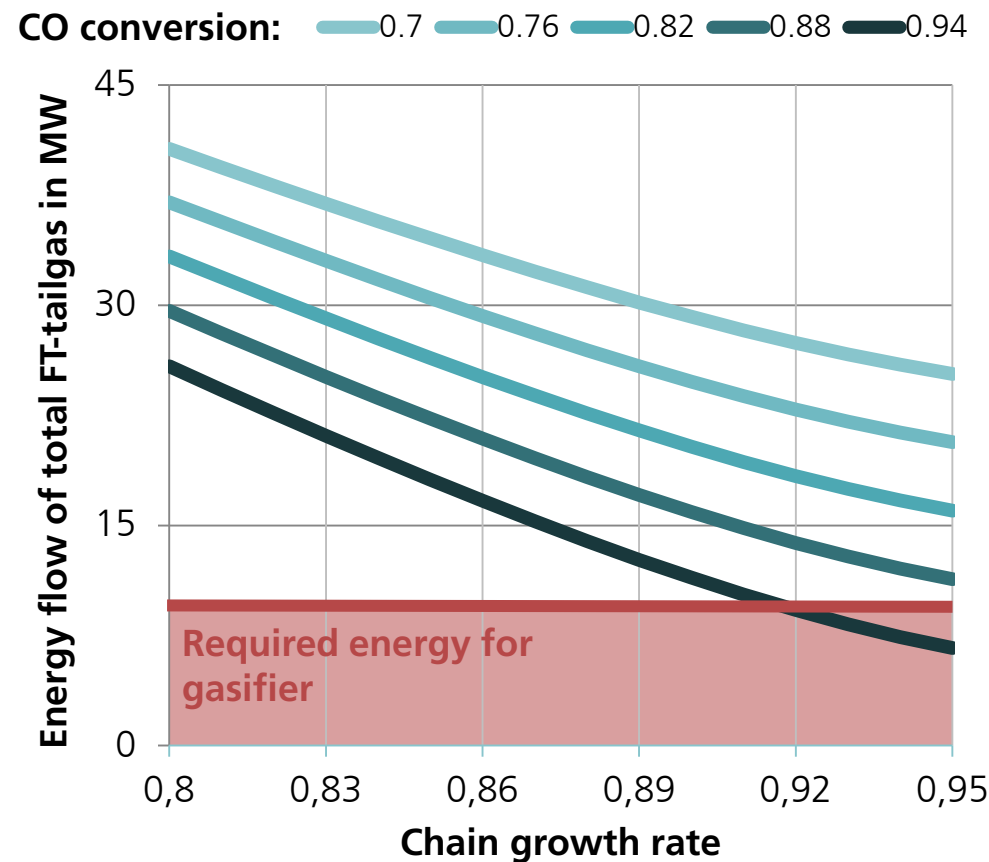
	Units	Case 1 Initial conditions	Case 2 incl. CO ₂ removal	Case 3 allothermal reforming
Power consumption	MW _e	8.1	7.4	7.1
FT-product	t/h	2.6	2.7	3.1
Energy flows				
Fuel	MW _{LHV}	31.9	32.6	38.3
Unused FT-tailgas	MW _{LHV}	33.3	33.6	22.2
Excess heat (> 400 °C)	MW _{th}	20.4	19.3	22.7
Efficiencies				
BtL _{LHV-based}	%	30.2	31.2	36.8
Fuel + FT-tailgas	%	62.0	63.4	58.1
incl. excess heat	%	81.4	81.9	79.9
Carbon usage	%	21.0	21.3	25.0





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TEA – Results using initial conditions

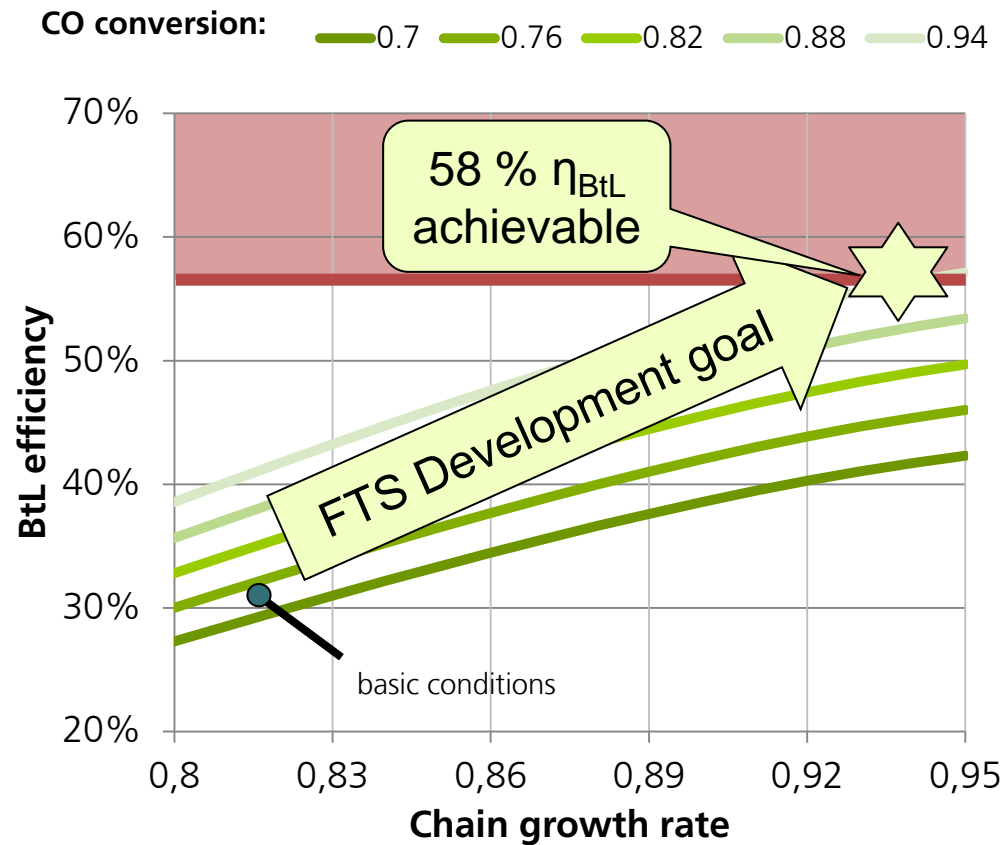




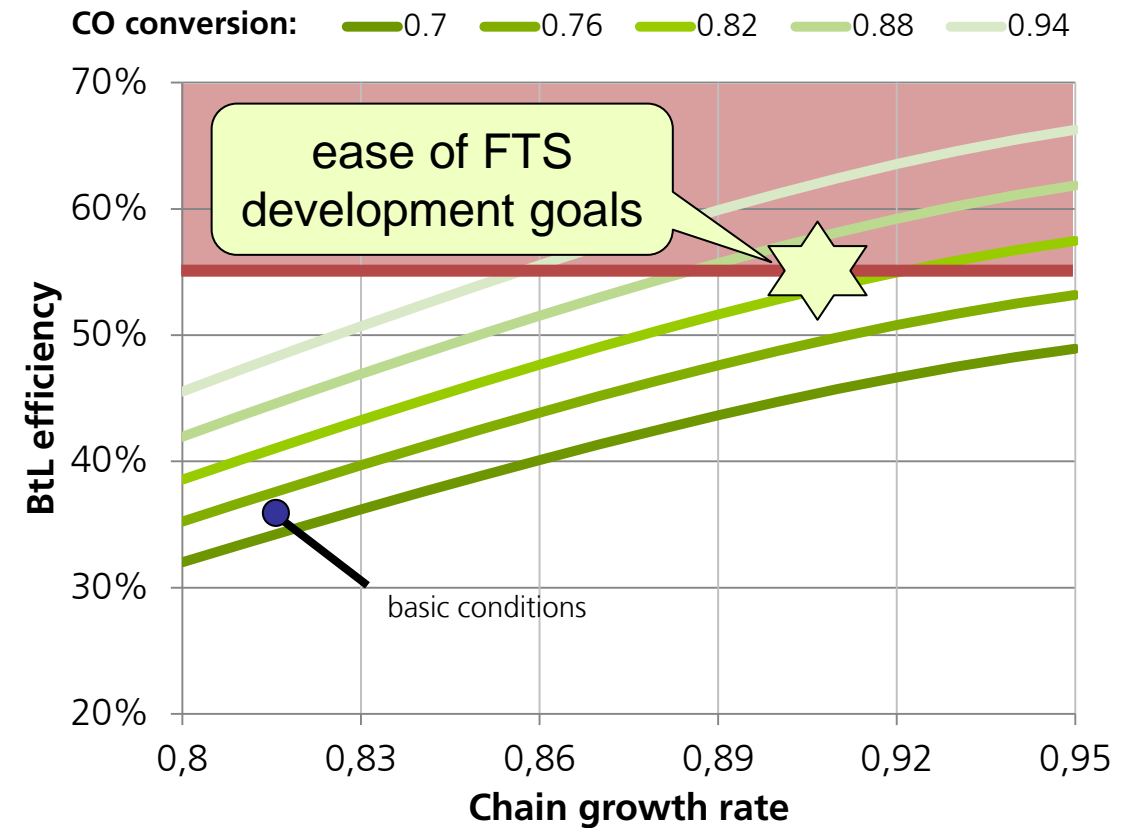
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TEA – Results

Case 2: incl. CO₂ removal



Case 3: allothermal reforming





COMSYN – Compact Gasification and Synthesis process for Transport Fuels

Project – Summary & Outlook

- Techno-economic assessment of different process configurations identifies / quantifies bottlenecks, optimization potential, process parameter impact
- First results on energy optimization show
 - tail gas energy losses shall be reduced, if local heat utilization is limited
 - CO₂ separation reduces compression work (electricity)
 - Allotherm reforming allows complete usage of internal heat production – eases FTS development goals

OUTLOOK

- Determine economic benefits and drawbacks of each case: Techno-economic assessment
- Experimental validation: test period 2018 – 2020 -> process data to be implemented into process model
- Develop business cases for Lithuania and Finland -> market introduction





Thank you for your attention!

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A satellite image of the Earth from space, showing the curvature of the planet, blue oceans, white clouds, and green landmasses. The image is positioned on the right side of the slide, partially overlapping the text.

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